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PW

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
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| 09/501,114 | 02/10/00 | TZENG Y | A029 1080 |

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| EXAMINER | |
|---|---|
| MARKHAM, W | |
| ART UNIT | PAPER NUMBER |
| 1762 | 3 |

DATE MAILED: 07/25/01

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trad marks**

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/501,114 | TZENG, YONHUA | |
| | Examiner | Art Unit | |
| | Wesley D Markham | 1762 | |

*-- The MAILING DATE of this communication appears on the cov r sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 February 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

## DETAILED ACTION

### *Oath/Declaration*

1. The applicant is advised that the declaration filed is unclear as to whether priority is claimed to U.S. provisional application serial # 60/119,771. While reference is made to this provisional application in the declaration, the statement "N/A" adjacent to the paragraph regarding domestic priority based on provisional applications under 35 U.S.C. 119 is confusing. It appears from the applicant's specification that priority to provisional application serial # 60/119,771 is desired, but the applicant is asked to state as much for the record in response to this Office Action.

### *Drawings*

2. This application has been filed with informal drawings which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.
3. The drawings filed on February 10, 2000 have been objected to by the draftsperson as set forth on the attached PTO 948 form.

### *Specification*

4. The disclosure is objected to because of the following informalities.
   - Page 11, lines 17 – 19 – The statement, "For example, ethanol ($CH_3CH_3OH$), isopropanol ($(CH_3)_2CHOH$), and acetone ($CH_3COCH_3$) have respective carbon to oxygen ratios of 2, 3, and 4" is confusing. The correct chemical formula for

ethanol is $CH_3CH_2OH$, and acetone appears to have a carbon to oxygen ratio of 3, not 4.

- Page 14, lines 5 – 6 – The statement, "diamond deposition rates of more than two orders of magnitude have been achieved in the present invention" is confusing. Specifically, it is unclear what the phrase, "more than two orders of magnitude" is in comparison to.

Appropriate correction is required.

5. The use of the trademark TEFLON on page 10, line 6 of the applicant's specification has been noted. It should be capitalized wherever it appears and be accompanied by the generic terminology.

   Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claim 18 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one

skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, the temperature limitation of between about 200° C and 1600° C is not enabled by the specification. Only temperatures in the range of about 300° C to 1600° C are enabled by the applicant's specification.

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 4 – 5, 11, and 17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. Specifically, each of the above claims contains the improper Markush group language, "group comprising of", which leaves the Markush group(s) open to other elements than those explicitly stated in the claims. For the purposes of examination, the examiner has interpreted the phrase, "group comprising of" to be equivalent to the phrase, "group consisting of."

### *Claim Rejections - 35 USC § 102*

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1 – 2, 4 – 7, and 9 – 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Idemitsu Petrochem Co (JP 05-247651 A).

13. Regarding Claim 1, Idemitsu Petrochem Co. teach a method of forming diamond crystals or a diamond film (Title), the method comprising disposing a substrate in a reaction chamber (Col.6, lines 47 – 50, and Col.7, lines 1 – 10, as verified through an oral translation from a USPTO translator), and subjecting a vaporized precursor comprising at least one carbon containing compound having a carbon to oxygen ratio greater than one to a plasma under conditions effective to dissociate the precursor and promote diamond growth on the substrate. Specifically, the gaseous precursor of Idemitsu Petrochem Co. can comprise acetone (e.g., a vaporized precursor comprising at least one carbon containing compound having a carbon to oxygen ratio greater than one) (Abstract). The substrate is treated with a carbon containing plasma (i.e., the precursor is dissociated) in order to form a diamond film on the substrate (i.e., diamond growth is promoted on the substrate) (Abstract).

14. Idemitsu Petrochem Co. teach all the limitations of Claims 2, 4 – 7, and 9 – 12, as set forth above in paragraph 13 and below, including a method wherein:

- Claim 2 – The precursor comprises a solution of methanol and the compound having a carbon to oxygen ratio greater than one. Specifically, Idemitsu Petrochem Co. teach that preferred precursor materials comprise methanol and acetone, and that these individual precursors can be mixed (paragraph [0013], as verified through an oral translation from a USPTO translator).

- Claim 4 – The precursor is selected from the group consisting of ethanol, isopropanol, acetone, and combinations thereof (paragraph [0013], as verified through an oral translation from a USPTO translator).
- Claim 5 – The precursor is a solution of methanol and a compound selected from the group consisting of ethanol, isopropanol, acetone, and combinations thereof (paragraph [0013], as verified through an oral translation from a USPTO translator).
- Claim 6 – The vaporized precursor is subjected to plasma conditions at a pressure between 1 mtorr and 250 torr (paragraph [0015], as verified through an oral translation from a USPTO translator).
- Claim 7 – The substrate is heated to a temperature between 300° C and 1600° C (paragraph [0015], as verified through an oral translation from a USPTO translator).
- Claim 9 – The substrate comprises a sheet or wafer of silicon, copper, aluminum, molybdenum, or alloys thereof (paragraph [0032], as verified through an oral translation from a USPTO translator).
- Claim 10 – The plasma is induced by electromagnetic energy (Abstract and paragraph [0014], as verified through an oral translation from a USPTO translator).
- Claim 11 – The electromagnetic energy has a frequency selected from the group consisting of direct current, radio frequency, and microwave (Abstract and

paragraph [0014], as verified through an oral translation from a USPTO translator).

- Claim 12 – The plasma is induced by microwave energy (Abstract).

***Claim Rejections - 35 USC § 103***

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

16. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Idemitsu Petrochem Co (JP 05-247651 A).

17. Idemitsu Petrochem Co. teach all the limitations of Claim 3 as set forth in paragraphs 13 – 14 above, except for a method wherein methanol is present in the precursor in an amount between about 0.5 wt.% and 99.5 wt.% of the precursor. However, Idemitsu Petrochem Co. teach that preferred precursor materials comprise methanol and acetone, and that these individual precursors can be mixed (paragraph [0013]). Idemitsu Petrochem Co. also teach that the preferred O/C ratio of the precursor is in the range of 0.33 to 2.0, or in other words, the preferred C/O ratio is in the range of 0.5 to 3.0 (Abstract). Since acetone has a C/O ratio of 3 and methanol has a C/O ratio of 1, it would have been obvious to one of ordinary skill in the art to mix the methanol and acetone in the desired proportions with the

reasonable expectation of obtaining the preferred C/O ratio in the range of 0.5 to 3.0 as taught by Idemitsu Petrochem Co. This desired mixing proportion would have included methanol in an amount between about 0.5 wt.% and 99.5 wt.% of the precursor and would have been optimized through routine experimentation by one of ordinary skill in the art.

18. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Idemitsu Petrochem Co (JP 05-247651 A) in view of Glesener et al. (USPN 5,381,755).

19. Idemitsu Petrochem Co. teach all the limitations of Claim 8 as set forth in paragraph 13 above, except for a method wherein the carbon containing compound (i.e., the precursor) further comprises a dopant element or moiety. However, Idemitsu Petrochem Co. teach that the diamond films produced by their method have desirable applications in electronic and electric materials (Use/Advantage). Glesener et al. teach that doped diamond can be produced by CVD utilizing hydrocarbon gases, and that natural diamond is not useful for electronic devices because of the inability to control the dopant level (Col.1, lines 32 – 50, and Col.3, lines 29 – 35). It is known to incorporate the dopant into one of the precursor gases used to deposit a diamond film (Col.3, lines 29 – 68, and Col.4). It would have been obvious to incorporate a dopant into the precursor compound of Idemitsu Petrochem Co. as taught by Glesener et al. with the reasonable expectation of controlling the dopant level of the diamond film and successfully producing electronic devices as desired by Idemitsu Petrochem Co.

20. Claims 13 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Idemitsu Petrochem Co (JP 05-247651 A) in view of Aida (USPN 5,225,275).

21. Regarding Claim 13, Idemitsu Petrochem Co. teach a plasma enhanced CVD of diamond crystals and diamond films on surfaces of a substrate (Title, Abstract, and paragraph [0032]). Idemitsu Petrochem Co. teach a dissociation zone (i.e., the plasma zone) and a deposition zone (i.e., the zone in the area of the substrate where the diamond film is formed (Abstract). Idemitsu Petrochem Co. also teach using a precursor comprising methanol and at least one carbon containing compound having a carbon to oxygen ratio greater than one (e.g., a mixture of methanol and acetone) (paragraph [0013]). The precursor is in vapor form (i.e., the conditions are effective to vaporize the precursor) (Abstract). Idemitsu Petrochem Co. do not explicitly teach that (1) the apparatus used has an inlet and an outlet, (2) the precursor is flowed through the dissociation zone and through the outlet, (3) the dissociation zone produces OH, H, O, and carbon containing radicals, and (4) the radicals are transported to the deposition zone to form the diamond film. Aida teaches a similar diamond CVD process that is performed in an apparatus having an inlet and an outlet (Figures 1 – 2), and the precursor is flowed through the dissociation zone and through the outlet (Figures 1 – 2, and Col.2, lines 9 – 20). By forming a plasma of the precursor material, the dissociation zone of Idemitsu Petrochem Co. would have inherently produced OH, H, O, and carbon containing radicals, and this radical formation in plasma is also taught by Aida (Col.3, lines 31 –

36, and Col.4, lines 11 – 25). Aida also teaches that the radicals are transported to the substrate surface (i.e., the deposition zone), whereby diamond is formed (Col.3, lines 31 – 36). It would have been obvious to one of ordinary skill in the art to use the apparatus of Aida to perform the process of Idemitsu Petrochem Co. with the reasonable expectation that the microwave CVD of diamond desired by Idemitsu Petrochem Co. would have been successfully performed in the microwave CVD apparatus of Aida (Figure 2).

22. The combination of Idemitsu Petrochem Co. and Aida teach all the limitations of Claims 14 – 18 as set forth above in paragraph 21 and below, including a method wherein:

- Claim 14 – The vaporized precursor is passed through an electrical discharge zone for dissociating the precursor in the dissociation zone. In Idemitsu Petrochem Co., the electrical discharge zone is the zone wherein the microwave energy is used to form a plasma (Abstract). Idemitsu Petrochem Co. also teach that other types of electrical energy such as high frequency, thermal filament, or ECR can be used to form the plasma (i.e., dissociate the precursor) (paragraph [0014]).
- Claim 15 – The precursor is introduced with methanol in an amount between about 0.5 wt.% and about 99.5 wt.% (see paragraph 17 above).
- Claim 16 – Methanol is supplemented with one or more carbon containing compounds containing carbon, hydrogen and oxygen with the atomic ratio of carbon to oxygen greater than one (e.g., acetone) (see paragraph 14 above).

- Claim 17 – The supplementing compound is selected from the group consisting of ethanol, isopropanol, acetone, and combinations thereof (paragraph [0013] of Idemitsu Petrochem Co. and paragraph 14 above).
- Claim 18 – The deposition zone is maintained at a temperature of between about 200° C and 1600° C and at a pressure between 1 mtorr and 250 torr (paragraph [0015] of Idemitsu Petrochem Co. and paragraph 14 above).

***Conclusion***

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 7:30 AM to 4:30 PM.

24. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-5408 for regular communications and (703) 305-3599 for After Final communications.

25. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Wesley D Markham
Examiner
Art Unit 1762

WDM
WDM
July 24, 2001

SHRIVE P. BECK
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700